

REMARKS

Reconsideration of the application is respectfully requested.

Status

Claims 1 - 6 are presently pending.

Claim Rejections Under 35 USC § 102

Claims 1 - 6 are rejected under 35 USC §102(e) as being anticipated by U.S. Patent No. 6,847,894 to Hasegawa ("Hasegawa").¹ Applicant traverses this rejection.

The present application claims priority from Japanese Patent Application No. 2003-113139, which was filed on April 17, 2003. To perfect this claim, Applicant timely filed a claim for priority to Japanese Patent Application No. 2003-113139 together with a certified copy of the priority document on April 15, 2004

The effective date for Hasegawa is its filing date of September 3, 2003. As the effective date for Hasegawa is later in time than the priority date for the present application, Applicant respectfully submits that Hasegawa must be disqualified as a reference against the present application. In further perfection of the priority claim, Applicant encloses a certified English translation of the certified priority document.

Accordingly, for at least these reasons, Applicant submits that claims 1 - 6 stand in condition for allowance, and therefore respectfully request that the rejection of claims 1 - 6 under 35 USC §102(e) be withdrawn.

¹ Although the Detailed Action indicates that the rejection is made on the basis of 35 USC §102(b), as the issue date for Hasegawa is later in time than the filing date for the present application, Applicant submits that the rejection should instead be made under 35 USC §102(e).


CONCLUSION

In view of the above amendments and remarks, applicant believes the pending application is in condition for allowance.

If there are any issues remaining which the Examiner believes could be resolved through either a Supplemental Response or an Examiner's Amendment, the Examiner is respectfully requested to contact the undersigned at the telephone number indicated below.

Dated: May 21, 2007

Respectfully submitted,

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STATEMENT

I, Makoto KONDO, of c/o NGB Corporation, Tranomon Est Bldg., 7-13, Nishi-Shimbashi 1-chome, Minato-ku, Tokyo 105-8408 Japan, hereby state that I am conversant with both the English and Japanese languages and certify to best of my knowledge and belief that the attached is a true and correct English translation of the priority document of Japanese patent application 2003-113139 filed on April 17, 2003.

Date: April 20, 2007

近藤 誠

Makoto KONDO

JAPAN PATENT OFFICE

This is to certify that the annexed is a true copy of the following application as filed with this Office.

Date of Application: April 17, 2003

Application Number: Patent Application No. 2003-113139

Applicant(s): FUJI JUKOGYO KABUSGHIKI KAISHA

April 26, 2004

Commissioner,
Japan Patent Office Yasuo IMAI
Issuance No. 2004-3035732

1 PATENT APPLICATION

2 (Document Name) Application for Patent

3 (Reference Number) RG017315

4 (Filing Date) April 17, 2003

5 (Addressee) Commissioner of Patent Office

6 (International Patent Class) B60R 21/00

7 (Title of Invention) Vehicle drive assist system

8 (Number of appended claims) 7

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19 (Indication of Fee) Number of Prepayment Book: 013387
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21 (List of Exhibits)
22 Name of Appended Document: Specification 1 copy
23 Name of Appended Document: Drawings 1 copy
24 Name of Appended Document: Summary 1 copy
25 General Authorization No. 9006595

1 (Necessity of Proof) Proof needed

2

1 [DOCUMENT] Specification

2 [TITLE OF THE INVENTION] Vehicle drive assist system

3 [SCOPE OF THE CLAIMS FOR PATENT]

4 [Claim 1]

5 A vehicle drive assist system characterized in being

6 furnished with:

7 frontal circumstances recognizing means for

8 recognizing a solid object in front of an own vehicle by processing

9 images taken by an imaging apparatus provided in a vehicle;

10 own vehicle crossing situation detecting means for

11 detecting a situation in which an own vehicle is going to cross

12 an oncoming lane;

13 oncoming waiting vehicle detecting means for detecting

14 an oncoming vehicle waiting in front of the own vehicle on the

15 oncoming lane;

16 oncoming straight vehicle detecting area establishing

17 means for establishing a detecting area for detecting an oncoming

18 vehicle traveling straight in the vicinity of the oncoming vehicle

19 waiting; and

20 oncoming straight vehicle detecting means for

21 detecting the oncoming vehicle traveling straight in the detecting

22 area.

23 [Claim 2]

24 The vehicle drive assist system described in claim 1,

25 characterized in that the own vehicle crossing situation detecting

means judge the situation where the own vehicle is going to cross the oncoming lane from the own lane when the vehicle speed of the own vehicle is low and the turn signal switch is in an operative condition to the oncoming lane.

[Claim 3]

The vehicle drive assist system described in claim 1 or claim 2, characterized in that the oncoming waiting vehicle detecting means detect an oncoming vehicle which exists within a preestablished distance in front of the own vehicle and the vehicle speed of the vehicle is low toward the own vehicle and the oncoming vehicle is detected on successively couple of frames as the oncoming waiting vehicle.

[Claim 4]

The vehicle drive assist system described in either of claims 1 to 3, characterized in that oncoming straight vehicle detecting area establishing means establish the oncoming straight vehicle detecting area in an area on the oncoming lane side of another object in case where the other object exists on the oncoming lane side of the oncoming waiting vehicle.

[Claim 5]

The vehicle drive assist system described in either of claims 1 to 4, characterized in that the oncoming straight vehicle detecting means judge that there is an oncoming vehicle traveling straight when a new solid object is detected in the oncoming straight vehicle detecting area.

1 [Claim 6]

2 The vehicle drive assist system described in either
3 of claims 1 to 5, characterized in having warning means for warning
4 in case where the oncoming vehicle traveling straight exists on
5 the oncoming lane.

6 [Claim 7]

7 The vehicle drive assist system described in claim 6,
8 characterized in that the warning means vary a warning according
9 to the position of the oncoming vehicle traveling straight.

10 [DETAILED DESCRIPTION OF THE INVENTION]

11 [0001]

12 (Field of industrial exploitation)

13 The present invention relates to a vehicle drive assist
14 system and more particularly to a vehicle drive assist system
15 capable of detecting an oncoming vehicle traveling straight which
16 is difficult to be found at intersections based on frontal
17 information obtained from a stereoscopic camera and the like.

18 [0002]

19 (Prior art)

20 When a vehicle make a right turn at intersections in
21 the "keep to the left" traffic system, in case where there are
22 oncoming vehicles waiting for turning right on oncoming lanes,
23 it is difficult for a driver to confirm oncoming vehicles
24 traveling straight. Under such situations, the driver must put
25 a lot of information such as oncoming vehicles, pedestrians

1 walking across a road ahead and the like in order and therefore
2 he or she is forced to bear lots of burdens.

3 [0003]

4 In order to reduce such burdens of the driver, patent
5 reference 1 discloses a technique in which a collision of a vehicle
6 turning right with an oncoming vehicle traveling straight in
7 intersections is prevented by arranging infrastructure to detect
8 the oncoming vehicle with an obstacle sensor installed in
9 intersections and warning a driver.

10 [0004]

11 However, in case of such a technique needing the
12 arrangement of infrastructure as described in the patent reference
13 1, the obstacle sensor and the warning system must be installed
14 in every intersection and a huge amount of money is needed and
15 long term preparations are necessary and it is difficult to actually
16 put the system into practical use.

17 [0005]

18 Hence, for example, Japanese Patent Application
19 Laid-open No. Toku-Kai 2001-101592 discloses a technique wherein
20 a vehicle itself has an ability to detect oncoming vehicles at
21 an early stage using a fish-eye lens installed in a bumper of
22 the vehicle or in the vicinity thereof.

23 [0006]

24 (Patent reference 1)

25 Toku-Kai-Hei 9-282592

1 [0007]

2 (Patent reference 2)

3 Toku-Kai 2001-101592

4 [0008]

5 (Problems to be solved by the invention)

6 However, according to the technique described in the
7 aforesaid patent reference 2, since the camera is installed in
8 a place most easily getting soiled, a front bumper and in a place
9 most easily effected by rain, there is fear that stains and raindrops
10 hinder accurate imaging. Further, in case where the fish-eye lens
11 is employed, the image apart from the center of the lens needs
12 a complicated correction processing in order to obtain precise
13 images and there occurs a large increase of cost.

14 [0009]

15 The present invention has been made in view of the
16 aforesaid situations. It is an object of the present invention
17 to provide a vehicle drive assist system having excellent
18 reliability, stability and having a simple construction and
19 capable of easily, accurately detecting an oncoming vehicle
20 traveling straight.

21 [0010]

22 (Means for solving the problem)

23 In order to attain the object, the vehicle drive assist
24 system described in claim 1 according to the present invention
25 is characterized in being furnished with frontal circumstances

1 recognizing means for recognizing a solid object in front of an
2 own vehicle by processing images taken by an imaging apparatus
3 provided in a vehicle, own vehicle crossing situation detecting
4 means for detecting a situation in which an own vehicle is going
5 to cross an oncoming lane, oncoming waiting vehicle detecting
6 means for detecting an oncoming vehicle waiting in front of the
7 own vehicle on the oncoming lane, oncoming straight vehicle
8 detecting area establishing means for establishing a detecting
9 area for detecting an oncoming vehicle traveling straight in the
10 vicinity of the oncoming vehicle waiting and oncoming straight
11 vehicle detecting means for detecting the oncoming vehicle
12 traveling straight in the detecting area.

13 [0011]

14 Also, the vehicle drive assist system described in claim
15 1, in the vehicle drive assist system described in claim 1, is
16 characterized in that the own vehicle crossing situation detecting
17 means judge the situation where the own vehicle is going to cross
18 the oncoming lane from the own lane when the vehicle speed of
19 the own vehicle is low and the turn signal switch is in an operative
20 condition to the oncoming lane.

21 [0012]

22 Furthermore, the vehicle drive assist system described
23 in claim 3, in the vehicle drive assist system described in claim
24 1 or claim 2, is characterized in that the oncoming waiting vehicle
25 detecting means detect an oncoming vehicle which exists within

1 a preestablished distance in front of the own vehicle and the
2 vehicle speed of the vehicle is low toward the own vehicle and
3 the oncoming vehicle is detected on successive, past couple of
4 frames as the oncoming waiting vehicle.

5 [0013]

6 Further, the vehicle drive assist system described in
7 claim 4, in the vehicle drive assist system described in either
8 of claims 1 to 3, is characterized in that oncoming straight
9 vehicle detecting area establishing means establish the oncoming
10 straight vehicle detecting area in an area on the oncoming lane
11 side of another object in case where the other object exists on
12 the oncoming lane side of the oncoming waiting vehicle.

13 [0014]

14 Further, the vehicle drive assist system described in
15 claim 5, in the vehicle drive assist system described in either
16 of claims 1 to 4, is characterized in that the oncoming straight
17 vehicle detecting means judge that there is an oncoming vehicle
18 traveling straight when a new solid object is detected in the
19 oncoming straight vehicle detecting area.

20 [0015]

21 Furthermore, the vehicle drive assist system described
22 in claim 6, in the vehicle drive assist system described in either
23 of claims 1 to 5, is characterized in having warning means for
24 warning in case where the oncoming vehicle traveling straight
25 exists on the oncoming lane.

1 [0016]

2 Furthermore, the vehicle drive assist system described
3 in claim 7, in the vehicle drive assist system described in either
4 of claims 6, is characterized in that the warning means vary a
5 warning according to the position of the oncoming vehicle traveling
6 straight.

7 [0017]

8 That is, the vehicle drive assist system described in
9 claim 1 recognizes a solid object in front of an own vehicle by
10 processing images taken by an imaging apparatus provided in a
11 vehicle by the frontal circumstances recognizing means, detects
12 a situation in which an own vehicle is going to cross an oncoming
13 lane by the own vehicle crossing situation detecting means, detects
14 an oncoming vehicle waiting in front of the own vehicle on the
15 oncoming lane by the own vehicle crossing situation detecting
16 means, establishes a detecting area for detecting an oncoming
17 vehicle traveling straight in the vicinity of the oncoming vehicle
18 waiting by the oncoming traveling vehicle detecting area
19 establishing means and detects the oncoming vehicle traveling
20 straight in the detecting area by the oncoming straight vehicle
21 detecting means.

22 [0018]

23 At this moment, specifically, as described in claim
24 2, the own vehicle crossing situation detecting means judge that
25 the own vehicle is going to cross the oncoming lane from the own

1 lane in case where the vehicle speed of the own vehicle is low
2 and the turn signal switch is in an operative condition to the
3 oncoming vehicle.

4 [0019]

5 Further, specifically, as described in claim 3, the
6 oncoming waiting vehicle detecting means detect as an oncoming
7 waiting vehicle, in case where the oncoming vehicle exists
8 within a preestablished distance in front of the own vehicle and
9 the oncoming vehicle speed of the vehicle is low toward the own
10 vehicle and the oncoming vehicle is detected on successive, past
11 couple of frames.

12 [0020]

13 Further, specifically, as described in claim 4, the
14 oncoming straight vehicle detecting area establishing means
15 establish the oncoming straight vehicle detecting area in an area
16 on the oncoming lane side of another solid object, in case where
17 the other solid object exists an area on the oncoming lane side
18 of the oncoming waiting vehicle.

19 [0021]

20 Further, specifically, as described in claim 5, the
21 oncoming straight vehicle detecting means judge that there is
22 an oncoming vehicle traveling straight when a new solid object
23 is detected in the oncoming straight vehicle detecting area.

24 [0022]

25 Further, specifically, as described in claim 6, the

1 vehicle drive assist system described in claim 6, if the drive
2 assist system is equipped with warning means, in case where the
3 oncoming vehicle traveling straight exists on the oncoming lane,
4 the warning means raises a warning to the driver. At this moment,
5 as described in claim 7, if the warning means can vary the way
6 of warning according to the position of the oncoming vehicle
7 traveling straight, the warning can be performed more
8 effectively.

9 [0023]

10 (Preferred embodiments of the invention)

11 Below, an embodiment of the present invention will be
12 described based on drawings.

13 Figs 1 to 5 show an embodiment of the present invention,
14 in which Fig. 1 is a schematic drawing showing a vehicle
15 incorporating a vehicle drive assist system, Fig. 2 is a
16 flowchart of a routine for a vehicle drive assist control, Fig.
17 3 is a flowchart of an oncoming straight vehicle detection routine,
18 Fig. 4 is an explanatory diagram showing a situation of a vehicle
19 making a right turn in an intersection, and Fig. 5 is an explanatory
20 diagram of an image taken ahead from an own vehicle in Fig. 4.

21 [0024]

22 In Fig. 1, reference numeral 1 denotes an own vehicle
23 on which a vehicle drive assist system 2 for detecting a presence
24 of a vehicle coming on straight at crossroads and for warning
25 a driver, is mounted.

1 [0025]

2 The vehicle drive assist system 2 has a pair (left and
3 right) of CCD cameras 3 using a solid-state image component such
4 as Charge Coupled Device and the left and right cameras 3 are
5 transversely mounted on a front ceiling of a passenger compartment
6 at a specified interval of distance, respectively. The respective
7 cameras take stereoscopic images of an outside object from
8 different view points.

9 [0026]

10 Further, the vehicle 1 has a vehicle speed sensor 4
11 for detecting a vehicle speed V, a turn signal lever 5 operated
12 by a driver when the vehicle 1 makes a turn and the like. These
13 detected signals indicative of the vehicle speed V, indicative
14 of left or right turns and frontal images taken by the pair of
15 CCD cameras 3 of the own vehicle 1 are inputted to a control
16 apparatus 6.

17 [0027]

18 Further, the control apparatus 6 inputs the own vehicle
19 speed V, the operating signal of the turn signal switch 5 and
20 the frontal images of the own vehicle 1 and warns the driver by
21 operating a warning lamp 8 and a warning buzzer 9 provided in
22 a combination meter 7 in case where a vehicle coming on straight
23 exists when the own vehicle 1 is going to make a right turn.

24 [0028]

25 That is, the control apparatus 6 is constituted by a

1 multi-micro processor having an image processor. The processing
2 of images sent from the CCD cameras 3 is performed as follows.
3 First, with respect to a pair of stereoscopic images taken by
4 the stereoscopic CCD camera 3, distance information over the entire
5 image is obtained from the deviation amount between corresponding
6 positions according to the principle of triangulation and distance
7 images representing three-dimensional distance distribution are
8 formed based on that distance information. Then, lane marker data,
9 side wall data such as guardrails, curbs and side walls arranged
10 along the road and solid object data such as vehicles and the
11 like, are extracted through the well known grouping process by
12 comparing the distance images with the three-dimensional road
13 profile data, side wall data, solid object data and the like stored
14 beforehand.

15 [0029]

16 Thus extracted lane marker data, side wall data and
17 solid object data are denoted by individually different numbers,
18 respectively. Further, the solid object data are classified into
19 a stationary object in standstill, a forward moving object moving
20 in the same direction as the own vehicle 1, an oncoming vehicle
21 coming against the own vehicle 1 and the like from the relationship
22 between the relative displacement of the distance from the own
23 vehicle 1 and the vehicle speed of the own vehicle 1.

24 [0030]

25 Further, the control apparatus 6 detects a situation

1 where the own vehicle 1 is in a transfer process from driving
2 straight to turning right off the own lane and detects a presence
3 of an oncoming waiting vehicle on the oncoming lane ahead of the
4 own vehicle 1. The oncoming waiting vehicle is classified into
5 two kinds, an oncoming vehicle waiting for right turn and an
6 oncoming vehicle traveling straight but waiting for right turn
7 of the own vehicle. Further, the control apparatus 6 establishes
8 an oncoming straight vehicle detection area wherein an oncoming
9 vehicle traveling straight on the oncoming lane is detected. In
10 case where a solid object exists in an image, this detection area
11 is established in the vicinity of the right edge of the object.
12 In case where another object is detected in a detection area
13 established in the next frame of the image, it is judged whether
14 or not there is difference between distant information of the
15 oncoming vehicle waiting right turn and distance information of
16 the new object. In case where there is no different distance
17 information, it is judged that the left side (when viewed from
18 the solid object) part of the new object is detected and the new
19 object is an oncoming vehicle traveling straight. This judgment
20 can eliminate possibility that a vehicle coming from the right
21 (when viewed from the own vehicle 1) is erroneously recognized
22 to be an oncoming vehicle traveling straight. Further, in case
23 where the oncoming vehicle traveling straight is detected, the
24 control apparatus 6 operates the warning lamp 8 and the warning
25 buzzer 9 according to a position where the oncoming vehicle

traveling straight exists. Further, the control apparatus 6 acts as frontal circumstance recognizing means, oncoming lane crossing intension detecting means, oncoming waiting vehicle detecting means, oncoming straight vehicle detecting area establishing means and oncoming straight vehicle detecting means and warning means.

[0031]

Next, the drive assist control program of the control apparatus 6 will be described by referring to a flowchart of Fig. 2. This routine is executed every specified time. First, at a step (hereinafter referred to as "S") 101, images, the own vehicle speed V and the operating signal input to the control apparatus 6 from the CCD camera 3, the vehicle speed sensor 4 and the turn signal switch 5, respectively.

[0032]

Then, the program goes to S102 where solid objects are extracted and recognized based on the images from the CCD camera 3.

[0033]

After that,, the program goes to S103 where an oncoming vehicle traveling straight which will be described hereinafter in detail is detected by an oncoming vehicle traveling straight detecting routine and goes to S104. At S104, it is judged whether or not the oncoming vehicle traveling straight is detected at S103.

1 [0034]

2 As a result of the judgment at S104, in case where no
3 oncoming vehicle traveling straight is detected, the program
4 leaves the routine and in case where an oncoming vehicle traveling
5 straight is detected, the program goes to S105.

6 [0035]

7 When an oncoming vehicle traveling straight is detected
8 and the program goes to S105, the control apparatus 6 outputs
9 an operating signal to the warning lamp 8 and the warning buzzer
10 9 according to the distance between the oncoming vehicle traveling
11 straight and the own vehicle 1 and the program leaves the routine.
12 The operating signal is outputted with higher frequency as the
13 distance between the oncoming vehicle and the own vehicle is short
14 and is outputted with lower frequency as the distance is far.
15 Further, the sound level of the warning buzzer 9 when the oncoming
16 vehicle is near is established to a larger level than that when
17 the oncoming vehicle is far.

18 [0036]

19 Next, the oncoming vehicle traveling straight detecting
20 routine at S103 will be described by referring to a flowchart
21 shown in Fig. 3. First, at S201, it is judged whether or not the
22 own vehicle 1 transfers to an oncoming vehicle detecting mode.
23 If the own vehicle 1 does not transfer to the oncoming vehicle
24 detecting mode, the program skips to S212 where the next frame
25 is checked, leaving the routine. The oncoming vehicle detecting

1 mode is a condition that the own vehicle speed is low (for example
2 15 kilometers/hour) and the turn signal switch 5 is turned on
3 for turning right.

4 [0037]

5 If it is judged at S201 that the own vehicle transfers
6 to the oncoming vehicle detecting mode, the program goes to S202
7 where it is judged whether or not a solid object exists in front
8 of the own vehicle 1 at a short distance (for example, 4 meters
9 to 12 meters). As a result of the judgment, if no solid object
10 exists, the program skips to S212 where the next frame is checked,
11 leaving the routine. Further, if a solid object exists, the program
12 goes to S203 where it is judged whether or not the solid object
13 is coming close to the own vehicle 1 at a low speed (for example,
14 below 15 kilometers/hour).

15 [0038]

16 As a result of the judgment at S203, if the solid object
17 is not coming close to the own vehicle 1 at a low speed, the program
18 skips to S212 where the next frame is checked, leaving the routine.
19 Further, if the solid object is coming close to the own vehicle
20 1 at a low speed, the program goes to S204 where it is investigated
21 whether or not the solid object has been detected successively
22 in a couple of past frames (for example, 3 frames).

23 [0039]

24 That is, in this condition, as shown in Fig. 4, there
25 is possibility that the solid object is an oncoming vehicle waiting

1 right turn or an oncoming vehicle traveling straight but waiting
2 for the own vehicle turning right. Hereinafter, these vehicles
3 are referred to as oncoming waiting vehicle. Such images as shown
4 in Fig. 5 are taken from the own vehicle 1. That is, it is judged
5 whether or not such images appear on successive three past frames.

6 [0040]

7 As a result of this judgment, in case where such images
8 do not appear on successive three past frames, the solid object
9 is judged to already pass or is judged to be a detection error
10 and the program skips to S212, leaving the routine.

11 [0041]

12 On the other hand, in case where the solid object is
13 detected successively in a couple of past frames, the program
14 goes to S205 in which it is judged that the solid object is an
15 oncoming waiting vehicle. At this moment, a recognition frame
16 Wa is formed around the oncoming waiting vehicle on the image
17 and an oncoming vehicle traveling straight detecting area is
18 established in the vicinity of the right (when viewed from the
19 own vehicle 1) edge of the recognition frame Wa.

20 [0042]

21 After that, the program goes to S206 where it is judged
22 whether or not another object always exists in the detecting area
23 described above. As a result of this judgment, in case where the
24 other object always exists, this solid object is deemed to be
25 either of another oncoming vehicle waiting right turn behind a

1 forefront oncoming vehicle waiting right turn, an oncoming vehicle
2 traveling straight but waiting own vehicle turning right or a
3 lateral side surface of the forefront oncoming vehicle waiting
4 right turn. Then, at S207, a new oncoming vehicle traveling
5 straight detecting area (new detecting area) is established in
6 the vicinity of the right (when viewed from the own vehicle 1)
7 edge of the other solid object and the same process as S206 is
8 repeated.

9 [0043]

10 As a result of the judgment at S206, in case where no
11 solid object always exists in that detecting area, the program
12 goes to S208 where the next frame is checked. At S209, it is judged
13 whether or not a new solid object appears in the detecting area
14 of the next frame.

15 [0044]

16 As a result of the judgment at S209, in case where a
17 new solid object appears in the detecting area of the next frame,
18 a recognition frame Wb of the new solid object is established
19 as shown in Fig. 5. The program goes to S210 where it is judged
20 whether or not only a right side (when viewed from the own vehicle
21 1) part of the new solid object is detected by judging whether
22 or not distance information different from distance information
23 to the new solid object and to the oncoming waiting vehicle,
24 respectively exists between the new solid object and the oncoming
25 waiting vehicle.

1 [0045]

2 As a result of the judgment at S210, in case where there
3 is a part having different distance values, the program skips
4 to S212 where the next frame is checked, leaving the routine.
5 Further, in case where there is no part having different distance
6 values, it is judged at S211 that the right side part of the new
7 solid object has appeared and this solid object is an oncoming
8 vehicle traveling straight and the judgment is outputted to the
9 warning lamp 8 and the warning buzzer 9. Then, the program goes
10 to S212 where the next frame is checked, leaving the routine.

11 [0046]

12 On the other hand, as a result of the judgment at S209,
13 in case where no new solid object is found at the detecting area
14 of the next frame, the program skips to S212 where the second
15 next frame is checked, leaving the routine.

16 [0047]

17 Thus, according to the embodiment of the present
18 invention, an oncoming vehicle traveling straight at an
19 intersection is detected easily and simply and the presence of
20 the oncoming vehicle can be warned to a driver only by attaching
21 the oncoming vehicle traveling straight detecting program to the
22 image process using a pair of CCD cameras 3 mounted on the passenger
23 compartment of a vehicle and by executing the program. As a result,
24 it is not necessary to develop infrastructure or a large cost
25 increase can be prevented because of the installation of a wide

1 angle camera at a front end of the vehicle.

2 [0048]

3 Further, since the pair of CCD cameras takes frontal
4 images in the passenger compartment of the vehicle, there is no
5 problem that stains or raindrops stick to the cameras and as a
6 result the vehicle drive assist system obtains excellent
7 reliability, stability and can detect an oncoming vehicle
8 traveling straight with good precision.

9 [0049]

10 Further, the oncoming vehicle traveling straight can
11 be detected at an early stage without calculating the traveling
12 course or vehicle speed of the vehicle.

13 [0050]

14 Further, according to the embodiment of the present
15 invention, when the oncoming vehicle traveling straight is found,
16 the vehicle drive assist system warns a driver by the warning
17 lamp 8 and the warning buzzer 9, however the system may warns
18 the driver only either of the warning lamp 8 and the warning buzzer
19 9. Further, the warning may be performed by sound. Further, in
20 case where the oncoming vehicle traveling straight exists, not
21 only the warning is raised to the driver, some kinds of braking
22 functions for inhibiting acceleration and starts of the own vehicle
23 (throttle control, transmission control, brake control and the
24 like) may be furnished. Further, in case where the present control
25 is executed in intersections, information from a car navigation

1 apparatus may be employed.

2 [0051]

3 Further, according to the embodiment of the present
4 invention, the pair of CCD cameras is used as imaging means, however,
5 the imaging means are not limited to this. A monocular camera
6 may be used as the imaging means. In this case, position information
7 (distance and direction) of the oncoming vehicle waiting and the
8 oncoming vehicle traveling straight is detected by radar
9 apparatuses using laser, electric wave, acoustic wave,
10 electromagnetic wave and the like and this position information
11 is transformed into a coordinate system on the image. Thus obtained
12 distance information is given to the oncoming vehicle waiting
13 and the oncoming vehicle traveling straight detected by the well
14 known image recognition technique. It is needless to say that
15 the present invention can be applied to the technique through
16 the position information.

17 [0052]

18 Further, the present embodiment has been described on
19 the basis of the keep to left traffic system, however in case
20 of the keep to right traffic system, the present invention can
21 be applied by replacing the word "right" with "left".

22 [0053]

23 (Effect of the invention)

24 As described above, according to the present invention,
25 the present invention needs no special infrastructure and has

1 an excellent reliability, stability, and simple structure and
2 the oncoming vehicle traveling straight can be detected easily
3 and accurately.

4 [0054]

5 [BRIEF DESCRIPTION OF DRAWINGS]

6 Fig. 1 is a schematic view showing a vehicle
7 incorporating a vehicle drive assist system according to the
8 present invention;

9 Fig. 2 is a flowchart of a routine for a vehicle drive
10 assist control;

11 Fig. 3 is a flowchart of an oncoming straight vehicle
12 detection routine;

13 Fig. 4 is an explanatory diagram showing a situation
14 of a vehicle making a right turn in an intersection; and

15 Fig. 5 is an explanatory diagram showing a frontal image
16 viewed from an own vehicle.

17 (Explanation of symbols)

18	1	Own vehicle
19	2	Vehicle drive assist system
20	3	CCD camera (stereoscopic system)
21	4	Vehicle speed sensor
22	5	Turn signal switch
23	6	Control apparatus (frontal circumstance recognizing
24		means, oncoming lane crossing intension detecting means,
25		oncoming waiting vehicle detecting means, oncoming

1 straight vehicle detecting area establishing means,
2 oncoming straight vehicle detecting means, and warning
3 means)
4 8 Warning lamp (warning means)
5 9 Waning buzzer (warning means)
6

[DOCUMENT] Written Abstract

[ABSTRACT]

(Object)

Providing a vehicle drive assist system having an excellent reliability, stability, simple structure and capable of easily and accurately detecting an oncoming vehicle traveling straight.

(Means for attaining the object)

A control apparatus 6 detects a situation of an own vehicle 1 turning right from an own lane to turn right in an intersection and detects an oncoming vehicle waiting for a right turn on an oncoming lane in front of the own vehicle 1 in the intersection. Further, the system establishes a detecting area in the vicinity of the right edge of the oncoming waiting vehicle. This detecting area is established in the vicinity of the right edge of another solid object in case where the other solid object always exists. In case where a new solid object is detected, the new solid object is detected as an oncoming vehicle traveling straight. Thus, the control apparatus 6, in case where the oncoming vehicle traveling straight is detected, operates the warning lamp 8 and the warning buzzer 9 according to the position where the oncoming vehicle traveling straight exists.

[SELECTED DRAWING]

Fig. 3

FIG. 1

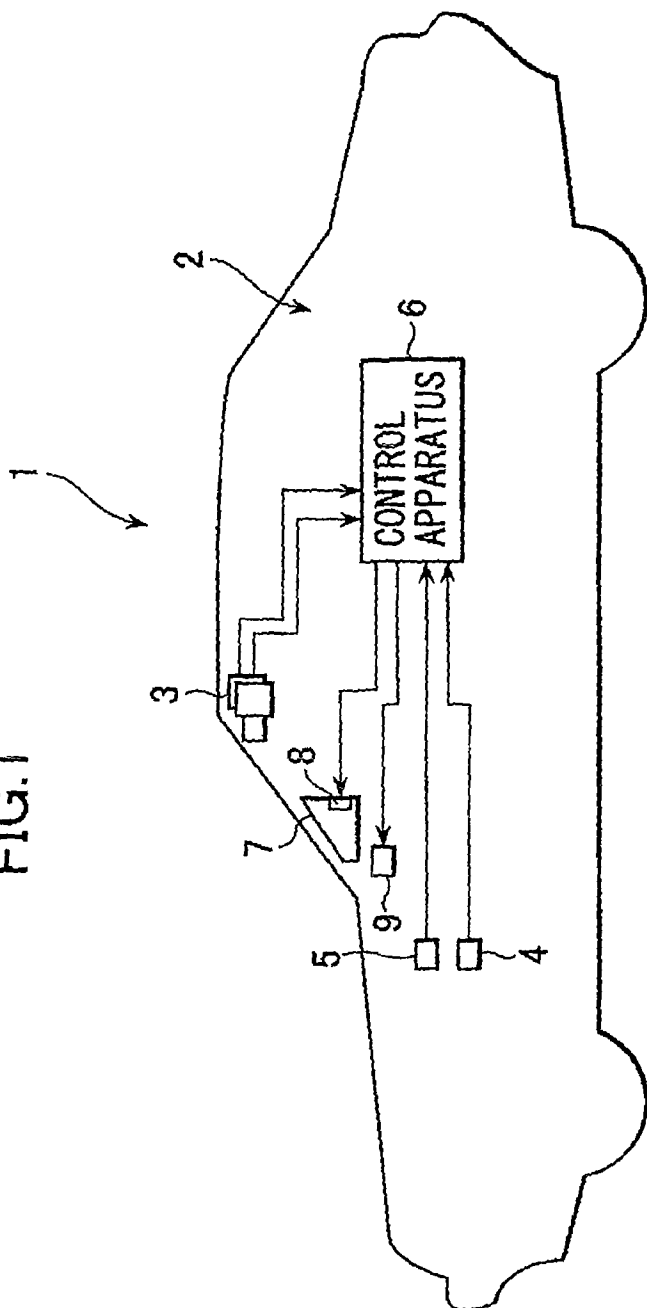


FIG.2

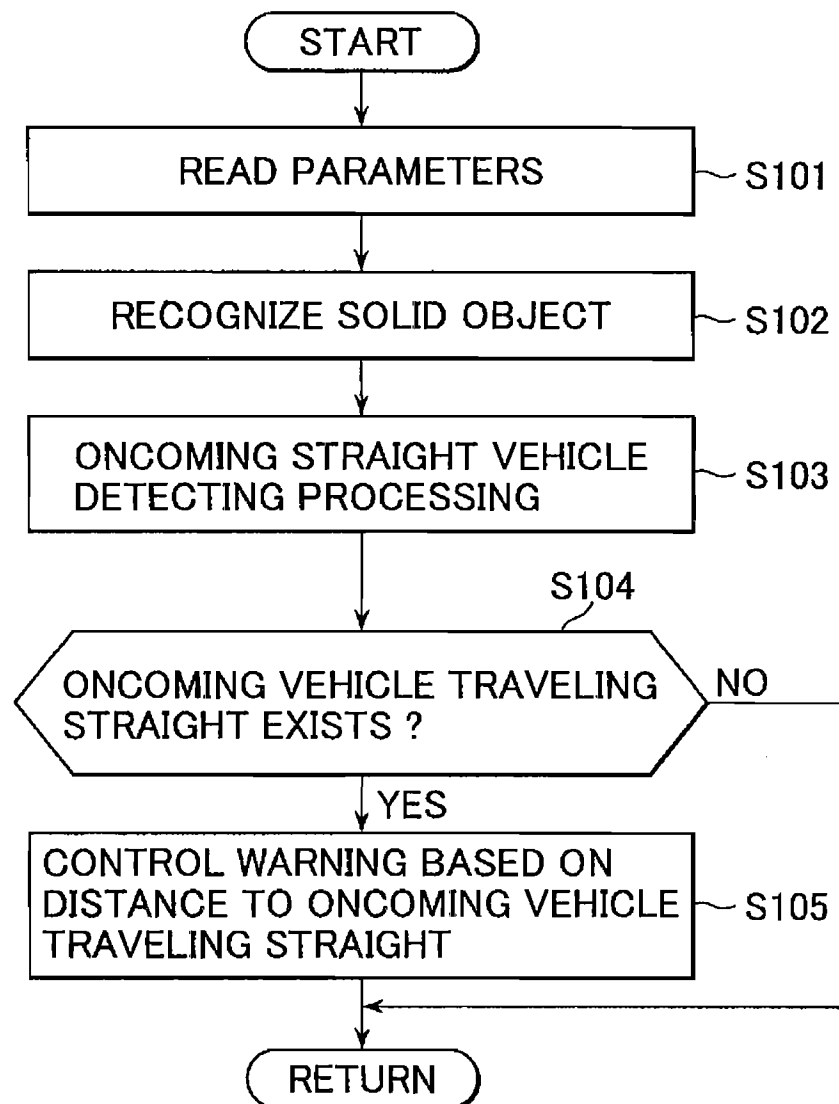


FIG.3

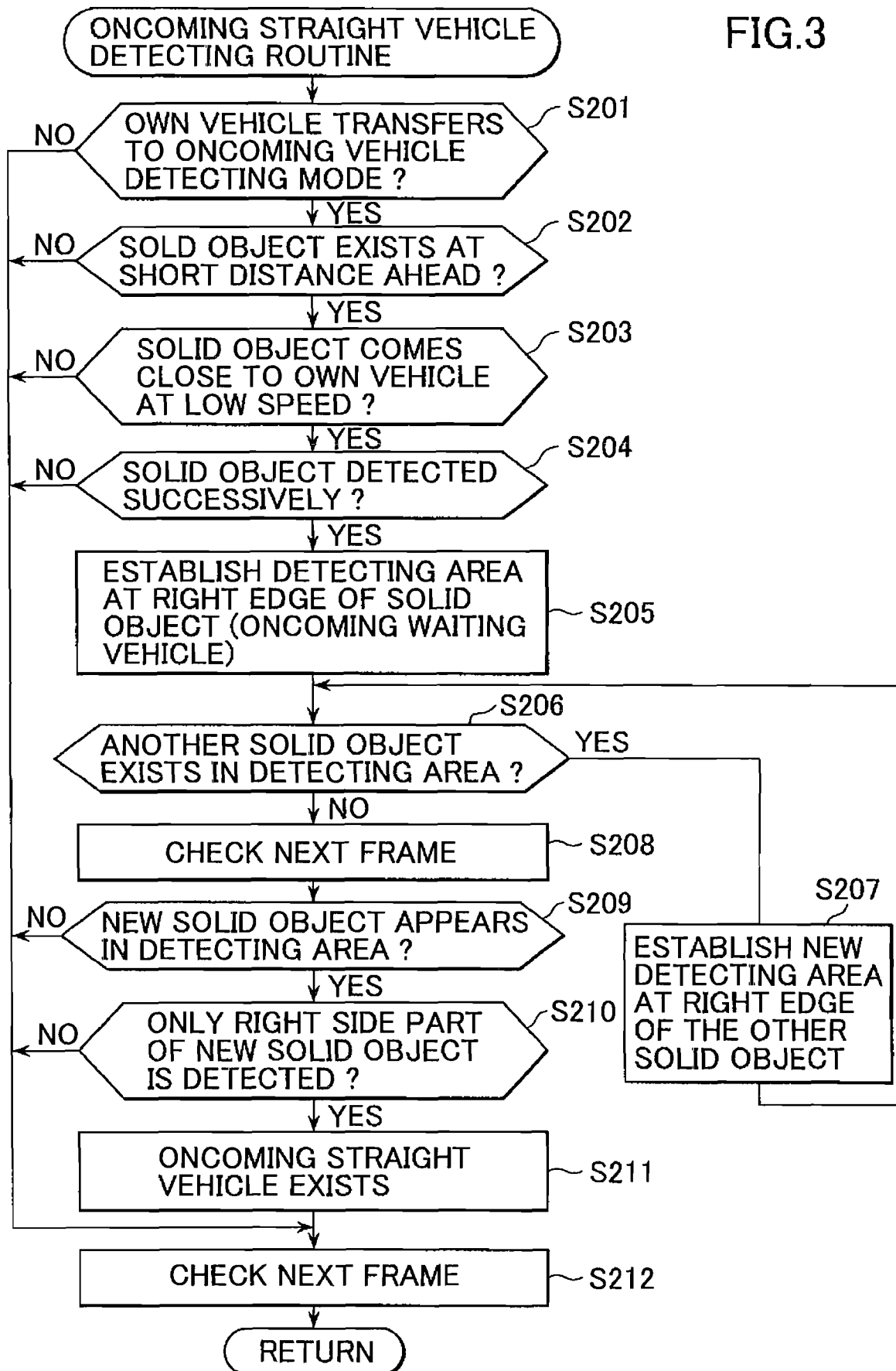


FIG.4

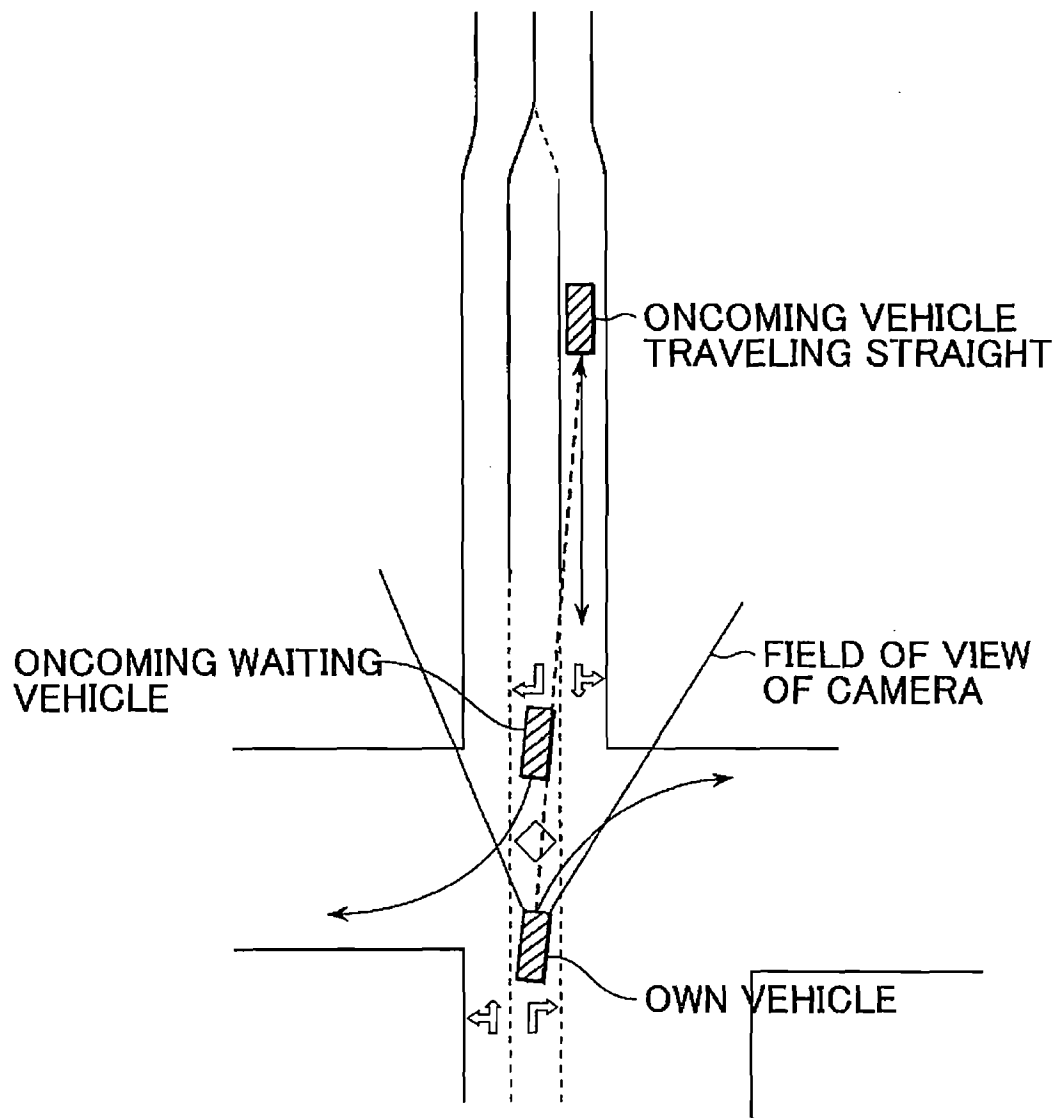


FIG.5

RECOGNITION FRAME
 W_a OF ONCOMING
WAITING VEHICLE

RECOGNITION FRAME W_b
OF ONCOMING VEHICLE
TRAVELING STRAGHT

RIGHT EDGE
OF W_a

LEFT EDGE OF W_b

